

What we claim is;

1. A longitudinal coupled multiple mode SAW filter comprising a plurality of IDTs disposed along a propagation direction of a surface wave on a piezoelectric substrate, wherein

5 an IDT is flanked on either side by IDTs,
a comb electrode of the IDT in the middle is connected with an input terminal, the other comb electrode of the middle IDT is grounded,

a comb electrode of the IDT on each side of the middle IDT is connected with an output terminal, the other comb electrodes of the side IDTs are grounded,

10 electrode fingers are so arranged that adjacent electrode fingers of the middle IDT and the IDT on one side make a connection between terminals or a connection between grounds and the other adjacent electrode fingers of the middle IDT and the IDT on the other side make a connection between a terminal and a ground.

15 2. The longitudinal coupled multiple mode SAW filter according to claim 1, comprising

two reflectors disposed on both sides of a plurality of IDTs along the propagation direction of the surface wave, wherein

the reflectors reflect the surface wave and trap oscillation energy of the surface
20 wave between them.

3. The longitudinal coupled multiple mode SAW filter according to claim 1, wherein

the width of adjacent electrode fingers of an input IDT and an output IDT is
25 designed to be smaller than the width of the other electrode fingers.

4. The longitudinal coupled multiple mode SAW filter according to claim 1,
wherein

the width of adjacent electrode fingers of the input IDT and the output IDT is
5 designed to be smaller than the width of the other electrode fingers, and

the pitch between adjacent electrode fingers of the input IDT and the output
IDT and electrode fingers next to the adjacent electrode fingers is designed to be
narrower than the pitch between the other electrode fingers.

10 5. The longitudinal coupled multiple mode SAW filter according to claim 4,
wherein

the width of a plurality of adjacent electrode fingers of the input IDT and the
output IDT is designed to be smaller than the width of the other electrode fingers.

15 6. The longitudinal coupled multiple mode SAW filter according to claim 1,
wherein

the output terminals are formed facing one direction.

7. The longitudinal coupled multiple mode SAW filter according to claim 1,
20 wherein

the grounds are established facing one direction.

8. The longitudinal coupled multiple mode SAW filter according to claim 1,
wherein

25 the output terminals are mutually formed in the opposite directions.

9. In an SAW filter comprising

a longitudinal coupled multiple mode SAW filter comprising a plurality of IDTs disposed along a propagation direction of a surface wave on a piezoelectric substrate

and

a resonator which includes one or a plurality of IDTs for exciting and receiving a surface acoustic wave, has antiresonant frequency approximately equivalent to cut-off frequency on the high-pass side of a pass-band of the longitudinal coupled multiple mode SAW filter and connects with the longitudinal coupled multiple mode SAW filter in series, the longitudinal coupled multiple SAW filter wherein

an IDT is flanked on either side by IDTs,

a comb electrode of the IDT in the middle is connected with an input terminal, the other comb electrode of the middle IDT is grounded,

a comb electrode of the IDT on each side of the middle IDT is connected with an output terminal, the other comb electrodes of the side IDTs are grounded,

electrode fingers are so arranged that adjacent electrode fingers of the middle IDT and the IDT on one side make a connection between terminals or a connection between grounds and the other adjacent electrode fingers of the middle IDT and the IDT on the other side make a connection between a terminal and a ground.

10. The SAW filter according to claim 9, wherein

the longitudinal coupled multiple mode SAW filter comprises two reflectors disposed on both sides of a plurality of IDTs along the propagation direction of the

surface wave, and

the reflectors reflect the surface wave and trap oscillation energy of the surface wave between them.

11. The SAW filter according to claim 9, wherein

the resonator is a one-port resonator.

12. The SAW filter according to claim 9, wherein

the resonator comprises two reflectors for reflecting the surface acoustic wave disposed on both sides of one or a plurality of IDTs along the propagation direction of the surface wave.

13. The SAW filter according to claim 9, wherein

the width of adjacent electrode fingers of an input IDT and an output IDT in the longitudinal coupled multiple mode SAW filter is designed to be smaller than the width of the other electrode fingers.

14. The SAW filter according to claim 9, wherein

the width of adjacent electrode fingers of the input IDT and the output IDT in the longitudinal coupled multiple mode SAW filter is designed to be smaller than the width of the other electrode fingers, and

the pitch between adjacent electrode fingers of the input IDT and the output IDT and electrode fingers next to adjacent the electrode fingers is designed to be narrower than the pitch between the other electrode fingers.

15. The SAW filter according to claim 14, wherein

the width of a plurality of adjacent electrode fingers of the input IDT and the output IDT is designed to be smaller than the width of the other electrode fingers.

16. The SAW filter according to the claim 9, wherein

the output terminals are formed facing one direction.

17. The SAW filter according to the claim 9, wherein

the grounds are established facing one direction.

18. The SAW filter according to claim 9, wherein

the output terminals are mutually formed in the opposite directions.

19. A longitudinal coupled multiple mode SAW filter comprising a plurality of IDTs disposed along a propagation direction of a surface wave on a piezoelectric substrate,

wherein

an IDT is flanked on either side by IDTs,

a comb electrode of the IDT in the middle is connected with an input terminal,

a comb electrode of the IDT on each side of the middle IDT is connected with an output terminal,

the width of adjacent electrode fingers of an input IDT and an output IDT is designed to be smaller than the width of the other electrode fingers.

20. A longitudinal coupled multiple mode SAW filter comprising a plurality of IDTs disposed along a propagation direction of a surface wave on a piezoelectric substrate,

wherein

an IDT is flanked on either side by IDTs,
a comb electrode of the IDT in the middle is connected with an input terminal,
a comb electrode of the IDT on each side of the middle IDT is connected with an
output terminal,

5 the width of adjacent electrode fingers of an input IDT and an output IDT is
designed to be smaller than the width of the other electrode fingers and

the pitch between adjacent electrode fingers of the input IDT and the output
IDT and electrode fingers next to the adjacent electrode fingers is designed to be
narrower than the pitch between the other electrode fingers.

10

21. The longitudinal coupled multiple mode SAW filter according to claim 20,
wherein

the width of a plurality of adjacent electrode fingers of the input IDT and the
output IDT is designed to be smaller than the width of the other electrode fingers.

15